

# SMRI '93

## Abstract Form

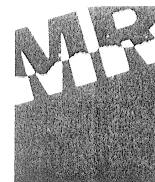
You must use the format detailed on page 2 and designate the beginning of each:

■ Purpose ■ Methods ■ Results ■ Conclusion

Your abstract must be double spaced and **cannot exceed 250 words**. Avoid excessive use of acronyms and abbreviations. If the four segments exceed 250 words, only your purpose and conclusion will be printed. Do not mechanically reduce your application to fit in the space provided. No graphs, halftones or tables can be included within abstract.

Title of Abstract:

\_\_\_\_\_ **Spin-Echo EPI of Localized Signal Enhancement** \_\_\_\_\_  
\_\_\_\_\_ **in the Human Brain during Task Activation** \_\_\_\_\_



CONTROL NO. \_\_\_\_\_  
Date Received \_\_\_\_\_  
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**PURPOSE:** Signal enhancement in active cerebral tissue, associated with decreased concentrations of deoxyhemoglobin, has been observed using gradient-echo (1-3) and spin-echo (4) techniques. A detailed comparison of brain activity-related signal enhancement in spin-echo and gradient-echo echo-planar imaging (EPI) sequences is made. Spin-echo and gradient-echo brain activity images are created and compared.

**METHOD:** Single shot spin-echo and gradient-echo EPI sequences (FOV = 24 cm, 64 x 64 resolution, 5 to 15 mm slice thickness) were performed on a 1.5 T Signa using a local three axis gradient coil. The motor cortex activation paradigm was self-paced finger movement. Three comparisons were made between spin-echo and gradient-echo sequences: 1. Brain activity-related signal enhancement dependence on TE, thus  $\Delta(1/T2^*)$  and  $\Delta(1/T2)$ . 2. Spatial location of the signal enhancement. 3. Optimal TE for brain function contrast to noise.

**RESULTS:** We find: 1. Signal enhancement is TE-dependent in both sequences, with  $\Delta(1/T2^*) = -.45 \text{ s}^{-1}$  and  $\Delta(1/T2) = -.15 \text{ s}^{-1}$ . 2. The spatial location of the enhancement in the brain is identical in both sequences. 3. Given that  $\Delta(1/T2)$  and  $\Delta(1/T2^*)$  are small relative to the tissue  $1/T2$  and  $1/T2^*$ , it is readily calculated that optimal contrast to noise occurs at  $TE \approx T2$  and  $T2^*$ . Optimal TE = 40 to 50ms for gradient-echo EPI, and 90 to 110ms for spin-echo EPI.

**CONCLUSION:** The primary source of functional susceptibility-related deoxyhemoglobin contrast apparently occurs in vessels which are subvoxel in size. While static susceptibility effects dominate, diffusing spins contribute to the dephasing. Therefore, a local increase in oxygenation causes signal enhancement in gradient-echo and spin-echo sequences.

### REFERENCES:

1. Kwong, K.K., Belliveau, J.W., Chesler, D.A., Goldberg, I.A., Weisskoff, R.M., et al. PNAS 89: 5675 - 5679, 1992.
2. Bandettini, P.A., Wong, E.C., Hinks, R.S., Tikofsky, R.M., and Hyde, J.S., Magn. Reson. Med. 25: 390-397, 1992.
3. Ogawa, S., Tank, D.W., Menon, R., Ellerman, J.M., Kim, S., et al. PNAS: June, 1992.
4. Bandettini, P.A., Wong, E.C., Hinks, R.S., Estkowski, L.S., and Hyde, J.S., SMRM 11'th Annual Meeting, Works In Progress: 719, 1992.